PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
I3049-PCT		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2004/014815	24.12.2004	24.12.2003

International Patent Classification (IPC) or national classification and IPC
G10K11/36, G01R33/02, H01L41/00, G11C11/16, H01F10/26, H01F10/32, H03K19/16

Applicant
INTERUNIVERSITAIR MICROELEKTRONICA CENTRUM VZW

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 8 sheets, as follows:
      ☐ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
24.10.2005	04.04.2006

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/014815

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages	
1-37	as originally filed
Claims, Numbers	
1-43	received on 27.10.2005 with letter of 24.10.2005
Drawings, Sheets	
1/14-14/14	as originally filed

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☒ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☒ the claims, Nos. 5
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-4,6-43
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-4,6-43
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-4,6-43
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item I
Basis of the report

The amendments filed with the letter dated 24.10.2005 introduce subject-matter which extends beyond the content of the application as filed, contrary to Article 34(2)(b) PCT. The amendments concerned are the following: claim 5.

Claim 5 is based on the originally filed claim 5. The originally filed claim 5 has disclosed that **either** ferromagnetic element is in contact with layer comprising piezoelectric material, **or** it is in contact with surface acoustic wave generating means. The new claim 5, however, depends on new claim 1 so that it discloses an **originally not described** situation in which ferromagnetic element is in contact with **both** layer comprising piezoelectric material and surface acoustic wave generating means.

Re Item V
Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1: GB-A-1 481 591 (STANDARD TELEPHONES CABLES LTD) 3 August 1977 (1977-08-03)
D2: US-A-4 078 186 (FOLEN VINCENT J ET AL) 7 March 1978 (1978-03-07)

2 The document D1 is regarded as being the closest prior art to the subject-matter of claims 1, 21, 25, 28, 32 and 41, and shows (claims 1 and 3; page 2, lines 4-85):

"*A device allowing magnetic property interaction, the device comprising*
- *a layer comprising piezoelectric material, said layer being adapted for transporting a surface acoustic wave having a frequency,*
- *a ferromagnetic element. having a ferromagnetic resonance frequency and being capable of magneto-elastic energy conversion,*

wherein said surface acoustic wave frequency is substantially equal to said ferromagnetic resonance frequency such that said surface acoustic wave interacts with

said ferromagnetic element."

The subject-matter of claim 1 differs from this known device in that

said layer comprising piezoelectric material is in ***direct*** *contact* (see page 16, line 31 - page 17, line 2) *with said ferromagnetic element so as to influence a magnetisation state of said ferromagnetic element.*

The subject-matter of claim 1 is therefore new (Article 33(2) PCT).

The problem to be solved by the present invention may be regarded as

how to provide manipulation of the magnetisation, i.e. magnetisation state or precessional movement, of the ferromagnetic element in a very fast way with high controllability (see page 2, lines 21-23).

The solution to this problem proposed in claim 1 of the present application is considered as involving an inventive step (Article 33(3) PCT) for the following reasons:

surface acoustic wave generating means generates the necessary strain for the magnetic element in order to change its magnetisation state and related properties (like switching behaviour, coercivity etc.). This altering of properties allows, among others, to **switch the magnetisation state at frequencies typically above 1 GHz**. Thus, **instead of using external magnetic fields** (as, for example, in D1 or D2), **magneto-elastic energy conversion is used** to modify the magnetisation state of the ferromagnetic element (see page 18, line 31 - page 19, line 15).

3 All independent claims (i.e. claims 1, 21, 25, 28, 32 and 41) are linked by the technical concept of generation of a surface acoustic wave in a layer comprising piezoelectric material whereby the layer is in contact with a ferromagnetic element such that the surface acoustic wave interacts with the ferromagnetic element so as to influence its magnetisation. Therefore, the claims 1, 21, 25, 28, 32 and 41 are linked by a single general inventive concept (Rule 13.1 PCT).

See section 2 of present communication for allowability of present claims 21, 25, 28, 32 and 41 in light of Articles 33(2) and (3) PCT.

4 Claims 2-4 and 6-20, 22-24, 26-27, 29-31, 33-40 and 42-43 are dependent on corresponding independent claims and as such also meet the requirements of the PCT with respect to novelty and inventive step.

5 The invention relates to methods, techniques and corresponding devices for controlled manipulation of magnetisation states of magnetic layers, cells and components. It relates also to RF resonators, magnetic logic and magnetic memories (Article 33(4) PCT).